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Original article

Diet quality, stress and common mental health problems: A cohort study of 121,008 adults

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SUMMARY

Background & aims: Overall diet quality may partially mediate the detrimental effects of stress and neuroticism on common mental health problems: stressed and/or neurotic individuals may be more prone to unhealthy dietary habits, which in turn may contribute to depression and anxiety. Lifestyle interventions for depressed, anxious or at-risk individuals hinge on this idea, but evidence to support such pathway is missing. Here, we aim to prospectively evaluate the role of overall diet quality in common pathways to developing depression and anxiety.

Methods: At baseline, N = 121,008 individuals from the general population (age 18–93) completed an extensive food frequency questionnaire, based on which overall diet quality was estimated. Participants also reported on two established risk factors for mental health problems, i.e. past-year stress exposure (long-term difficulties, stressful life-events) and four neuroticism traits (anger-hostility, self-consciousness, impulsivity, vulnerability). Depression and anxiety were assessed at baseline and follow-up (n = 65,342, +3.6 years). Overall diet quality was modeled as a mediator in logistic regression models predicting the development of depression and anxiety from common risk factors.

Results: High stress and high neuroticism scores were - albeit weakly - associated with poorer diet quality. Poor diet quality, in turn, did not predict mental health problems. Overall diet quality did not mediate the relationship between stress/neuroticism and common mental health problems: effects of stress, neuroticism and stress-by-neuroticism interactions on mental health problems at follow-up consisted entirely of direct effects (98.6%–100%).

Conclusions: Diet quality plays no mediating role in two established pathways to common mental health problems. As overall diet quality was reduced in stressed and neurotic individuals, these groups may benefit from dietary interventions. However, such interventions are unlikely to prevent the onset or recurrence of depression and anxiety.

1. Introduction

Common pathways to developing of depression and anxiety may be partially mediated by overall diet quality: at-risk individuals such as those exposed to stress and/or those with high levels of neuroticism may be more prone to unhealthy dietary

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habits, which in turn may contribute to the development of depression and anxiety symptoms [1]. Dietary interventions for individuals with or at risk for depression or anxiety hinge on this idea. A high-quality or healthy diet consists of regular consumption of fruits, vegetables, low-fat dairy products, whole-grain products, nuts, legumes, fish, oils and soft margarines, and limited consumption of red/processed meat, butter and sugar-sweetened beverages [2]. In a 2015 systematic review, eight out of seventeen whole-diet intervention studies for depressed patients reported positive effects on depression symptoms, while nine studies reported no effect [3].

The suggested partial mediation model (Fig. 1a) implies that A) established risk factors for depression/anxiety affect diet quality; and B) diet quality affects the risk of depression and anxiety. Evidence for the A-paths is limited yet compelling: cross-sectional observational studies have shown that diet quality is reduced in stressed [4] and highly neurotic [5,6] individuals. Moreover, stress exposure in laboratory settings resulted in increased consumption of unhealthy food products [7,8], especially in highly neurotic individuals [9].

Most controversial, however, is the B-path, i.e. a causal effect of overall diet quality on depression/anxiety. Observational studies have shown poorer diet quality in depressed versus non-depressed individuals, although null findings are common as well [10]. In a meta-analysis of only prospective studies, poor diet was associated with depression cross-sectionally, but did not predict the development of future depression [11]. While some randomized controlled trials have suggested that interventions aiming to improve diet quality may reduce depression/anxiety symptoms, others have yielded null effects [3,12].

Lifestyle interventions for patients with mental health conditions gain popularity among health care providers and policymakers. The role of diet in mental health thus urgently needs addressing, especially in relation to known risk factors. Here, in an unprecedentedly large population-based sample, we assessed the mediating role of overall diet quality in the effects of stress and neuroticism on the development of depression and anxiety.

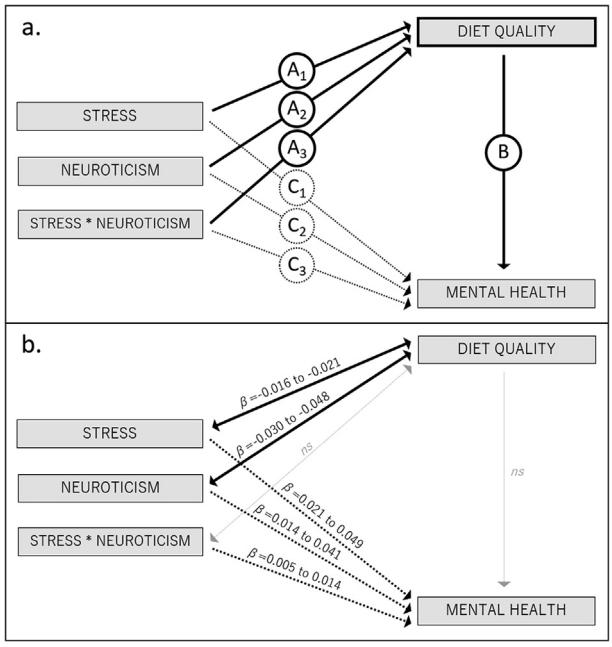

Fig. 1. Top figure (a) shows the proposed partial mediation model. Bold lines indicate the indirect or mediated paths from stress, neuroticism and their interaction to depression/anxiety via overall diet quality. Significant paths are shown in the bottom figure (b).

2. Materials and methods

2.1. The lifelines cohort

Lifelines is a prospective population-based cohort study of 167,729 persons from the North of the Netherlands. It assesses biomedical, socio-demographic, lifestyle and psychological factors contributing to health and disease [13]. The current baseline sample comprised all N = 121,008 adults with reliable dietary assessment data (see below, flow chart in Fig. 2). Follow-up data was collected on average 3.6 years after baseline (SD = 0.9; n = 65,342; 54.0%). Written informed consent was obtained from all participants. Lifelines is conducted according to the principles of the Declaration of Helsinki and is approved by the ethics committee of the University Medical Center Groningen, Netherlands.

Neighborhood socio-economic status (NSES) was derived from two Dutch governmental institutes for societal issues [14]. At regular intervals, NSES scores by postal code are estimated based on the inhabitants' educational level, income and job prospective. Across the country, mean-centered scores in 2006–2010 ranged from −8.2 (most deprived neighborhood) to +2.9 (most affluent neighborhood). In our sample, NSES ranged from −7.6 to +2.9 (Mean = −0.7; SD = 1.1). Participants self-reported their highest educational level achieved, which was re-categorized into lower, middle or higher education [15]. At baseline, height and weight were measured on site to calculate body mass index (BMI) in kg/m^2.

2.2. Assessment of diet quality

Participants self-reported past-month food intake using a 110-item semi-quantitative food frequency questionnaire (FFQ) [16]. For each food-item, participants reported consumption frequency on a seven-point categorical scale (ranging from "not this month"

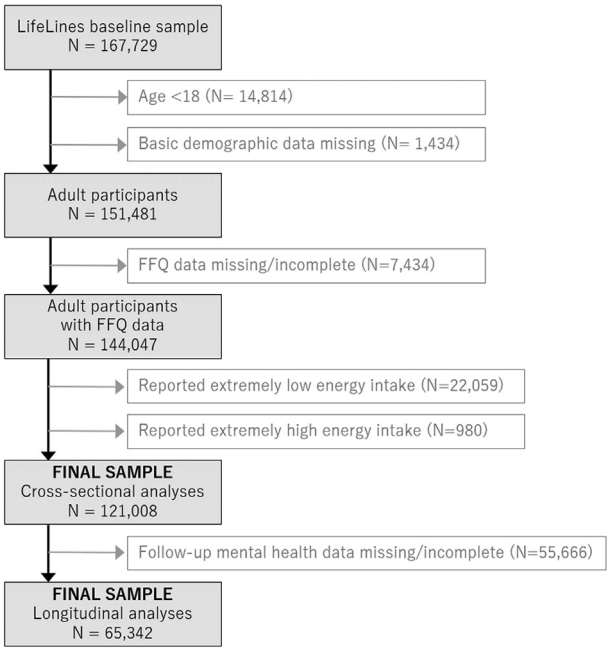

Fig. 2. Participant flow diagram.

to "6–7 days/week") and estimated their portion size. From the FFQ data, total energy intake/day was estimated using the 2011 Dutch food composition database [17]. Reliability was assessed by comparing total energy intake to basal metabolic rate as estimated by the Schofield equations [18]. Participants reporting <0.79 or >2.49 times the amount of energy required according to age, sex and height (i.e., plus/minus 2SD) were excluded.

Lifelines Diet Score (LLDS) is a food-based assessment of overall diet quality, based on international evidence for diet–disease relations and in line with the 2015 Dutch Dietary Guidelines [19]. Intake of nine food groups with established positive health effects (vegetables, fruits, whole-grain products, legumes and nuts, fish, oils and soft margarines, unsweetened dairy, coffee, tea) in grams per 1000 kcal is categorized into quintiles and scored 0–4 points. Inversely, intake of three food groups with negative health effects (red/processed meat, butter and hard margarines, sugar-sweetened beverages) is scored as 4–0 points. Food groups for which evidence of health effects is absent/weak are not taken into account. LLDS is calculated as the sum of positive and negative food group quintile scores (range 0–48). Higher scores indicate a healthier diet.

2.3. Assessment of mental health

The systematic Mini International Neuropsychiatric Interview (MINI) [20] was administered by trained interviewers at baseline, and in digital format (on-site) at follow-up. Depression and anxiety symptoms occurring within six months preceding the interview were assessed. Participants who fulfilled DSM-IV-TR diagnostic criteria for one or more of the following disorders were identified as having a depressive of anxiety disorder: major depressive disorder, dysthymia, social anxiety disorder, panic disorder, agoraphobia, generalized anxiety disorder. Participants who did not meet diagnostic criteria for any of these disorders were identified as having no depressive of anxiety disorder.

2.4. Stress and neuroticism

Past-year exposure to 13 stressful life-events (SLE, e.g., serious illness) was assessed at baseline using the self-administered List of Threatening Experiences (0 = no, 1 = yes, range sum score = 0–13) [21]. On the Long-term Difficulties Inventory, participants indicated past-year exposure to long-term difficulties (LTD) in 12 life domains (e.g. finances/work; 0 = not, 1 = somewhat, 2 = very much; range sum score = 0–24).

At baseline, 64 selected items of the 240-item NEO personality index (NEO-PI-R [22]) were administered, including the items constituting neuroticism facets anger-hostility, self-consciousness, impulsivity and vulnerability. Each facet consists of eight items scored on a five-point Likert scale (e.g., "I am a steady person"; 1 = "strongly disagree" to 5 = "strongly agree"; range facet sum scores = 8–40).

2.5. Statistical analyses

All analyses were performed in R version 1.1.383 (LAVAAN package version 0.5–23.1097) [23]. For each combination of stress indices and neuroticism facets, a mediated logistic regression model was estimated to predict mental health outcomes at follow-up. Using ML-estimation with 1000 bootstraps and a logit link-function, β coefficients and 95% confidence intervals were estimated for the following paths: associations between stress exposure and diet quality (path A_1), neuroticism and diet quality (A_2), and stress-by-neuroticism interaction and diet quality (A_3); the effect of diet quality on the development of depression/anxiety (path B); the *direct effects* of stress (path C_1), neuroticism (C_2) and stress-by-neuroticism interaction (C_3) on depression/anxiety; the *indirect effects* of stress, neuroticism and stress-by-neuroticism interactions on depression/anxiety via diet quality (A_1*B, A_2*B and A_3*B, respectively); and *total effects*, i.e. the sum of direct and indirect effects. Baseline depression/anxiety, age, sex, NSES, educational attainment and BMI were included as covariates. Note that paths B and $C_{1\text{-}3}$ are longitudinal supporting causal inference. In the A-paths, predictors and outcome variables were measured simultaneously.

Main effects of neuroticism facets and stress indices were estimated multiple times (e.g., the main effect of impulsivity was estimated once alongside SLE and once alongside LTD). We report the averaged parameters of each stress index when modeled alongside different neuroticism facets, and vice versa. Non-averaged outcomes (Supplementary Table [ST]1) are reported in the main paper when they do not match averaged outcomes. In our sample, $\beta = 0.004$ (SE = 0.001) would reach significance at a Bonferroni-corrected $\alpha = 0.0021$ (24 tests: 3 predictors [stress, trait, interaction]*2 stress indices*4 facets). Therefore, to indicate effect sizes for direct, indirect, total effects and path B, we report the percentage change in odds of developing depression/anxiety with one SD change in the predictor, calculated as $\exp(\beta_{predictor})$. For A-paths, we present the change in LLDS for every unit of change in the predictor. To assess validity and facilitate interpretation of our findings, B-paths and indirect/mediation paths were re-evaluated in cross-sectional models, i.e. predicting baseline rather than follow-up depression/anxiety. Analyses were also repeated with continuous rather than binary follow-up mental health outcomes, with separate depression and anxiety outcomes, and in stratified samples: males/females, younger/older participants (median-split), and only those with depression/anxiety at baseline (n = 10,900).

3. Results

Table 1 summarizes the sample characteristics. As expected, baseline stress indices, neuroticism facets and their interaction terms significantly predicted depression/anxiety at follow-up (total effects). With 1SD increase in exposure to stressful life events, the odds of developing depression/anxiety increased with 2.1% (CI = 1.8–2.4%). With 1SD increase in exposure to long-term difficulties, the odds of developing depression/anxiety increased with 5.0% (CI = 4.7–5.4%). For the neuroticism facets, the increase in the odds of developing depression/anxiety per SD ranged from 1.4% (impulsivity, CI = 1.2–1.7%) to 4.2% (vulnerability, CI = 3.9–4.5%; Fig. 1b). Finally, all eight stress-by-neuroticism interaction terms predicted depression/anxiety, with effects ranging from +0.5% to +1.4%.

3.1. Overall diet quality, stress and neuroticism (Path A)

Exposure to stressful life-events was negatively associated with diet quality (Table 2). Experiencing one additional stressful life-event (range = 0–13) was associated with −0.09 points (CI = −0.05 to −0.12 points) on the diet quality scale (range = 0–48). For long-term difficulties, the averaged A-path was not significant. This non-significant average was driven by the model in which long-term difficulties were modeled alongside anger-hostility (ST1); in all other models, long-term difficulties were associated with diet quality with effects ranging from −0.10 to −0.11 diet quality points per SD. One unit increase on the long-term difficulties scale (range = 0–24) resulted in −0.04 (CI = −0.02 to −0.06) to −0.05 (CI = −0.03 to −0.07) diet quality points (Fig. 1b).

All neuroticism facets (range = 8–40) were associated with diet quality as well. With every unit increase on the anger–hostility scale, diet quality decreased with 0.06 points (CI = −0.05

Table 1
Descriptive statistics.

	Males		Females	
	Mean/N	SD/%	Mean/N	SD/%
N	N = 50,164	41.5%	N = 70,844	58.5%
Age	45.44	13.19	44.38	12.98
Neighborhood socio-economic status	−0.64	1.06	−0.66	1.07
Educational attainment:				
Low	N = 13,029	26.5%	N = 18,145	26.5%
Middle	N = 19,199	39.1%	N = 28,344	41.3%
High	N = 16,887	34.4%	N = 22,067	32.2%
Depression/anxiety at baseline				
Any	N = 3193	6.4%	N = 7707	10.9%
Major depressive disorder	N = 704	1.4%	N = 1709	2.4%
Dysthymia	N = 371	0.8%	N = 907	1.3%
Generalized anxiety disorder	N = 1453	2.9%	N = 3478	4.9%
Panic disorder	N = 219	0.4%	N = 547	0.8%
Agoraphobia	N = 1270	2.5%	N = 3315	4.7%
Social phobia	N = 378	0.8%	N = 647	0.9%
Depression/anxiety at follow-up[a]				
Any	N = 1918	7.2%	N = 4413	11.4%
Major depressive disorder	N = 608	2.3%	N = 1195	3.1%
Dysthymia	N = 251	1.0%	N = 556	1.5%
Generalized anxiety disorder	N = 1114	4.2%	N = 2646	6.8%
Panic disorder	N = 89	0.3%	N = 246	0.6%
Agoraphobia	N = 472	1.8%	N = 1198	3.1%
Social phobia	N = 290	1.1%	N = 452	1.2%
BMI (in kg/m^2)	26.19	3.53	25.59	4.50
Total energy intake (in kcal)	2436.26	599.64	1881.06	433.61
Lifelines Diet Score	22.47	5.66	24.93	6.07
Neuroticism:				
Anger-hostility	18.67	4.42	18.89	4.27
Self-consciousness	18.75	4.23	20.56	4.69
Impulsivity	21.91	3.75	22.55	3.98
Vulnerability	17.23	3.90	19.04	4.15
Stress exposure:				
Stressful life events	1.13	1.37	1.24	1.39
Long-term difficulties	2.19	2.21	2.68	2.52

[a] Proportion of participants with valid follow-up MINI assessment, n = 65,342.

Table 2
Main findings.

Path A: stress/neuroticism & overall diet quality						
		β	SE	P		change/SD$_{PRED}$[a]
Stress[b]	SLE	−0.0207	0.0041	<0.0001	***	−2.0%
	LTD	−0.0155	0.0045	0.0277		−1.5%
Neuroticism[c]	A	−0.0476	0.0042	<0.0001	***	−4.6%
	S	−0.0304	0.0041	<0.0001	***	−3.0%
	I	−0.0312	0.0042	<0.0001	***	−3.1%
	V	−0.0345	0.0043	<0.0001	***	−3.4%
Interaction	SLE * A	−0.0060	0.0038	0.111		−0.6%
	SLE * S	0.0037	0.0040	0.350		−0.4%
	SLE * I	−0.0050	0.0040	0.205		−0.5%
	SLE * V	0.0009	0.0036	0.809		+0.1%
	LTD * A	−0.0052	0.0036	0.150		−0.5%
	LTD * S	0.0048	0.0037	0.189		+0.5%
	LTD * I	0.0021	0.0037	0.569		+0.2%
	LTD * V	0.0032	0.0035	0.364		+0.3%
Path B: overall diet quality → depression/anxiety						
		β	SE	P		change/SD$_{PRED}$[d]
	LLDS	−0.0006	0.0013	0.6773		−0.1%
Path C: stress/neuroticism → depression/anxiety						
		β	SE	P		change/SD$_{PRED}$[d]
Stress[b]	SLE	0.0211	0.0014	<0.0001	***	+2.1%
	LTD	0.0488	0.0017	<0.0001	***	+5.0%
Neuroticism[c]	A	0.0305	0.0014	<0.0001	***	+3.1%
	S	0.0297	0.0015	<0.0001	***	+3.0%
	I	0.0143	0.0013	<0.0001	***	+1.4%
	V	0.0408	0.0015	<0.0001	***	+4.2%
Interaction	SLE * A	0.0101	0.0015	<0.0001	***	+1.0%
	SLE * S	0.0114	0.0015	<0.0001	***	+1.1%
	SLE * I	0.0068	0.0015	<0.0001	***	+0.7%
	SLE * V	0.0099	0.0014	<0.0001	***	+1.0%
	LTD * A	0.0136	0.0015	<0.0001	***	+1.4%
	LTD * S	0.0115	0.0015	<0.0001	***	+1.2%
	LTD * I	0.0050	0.0015	0.0010	**	+0.5%
	LTD * V	0.0136	0.0015	<0.0001	***	+1.4%

Abbreviations: A, anger-hostility; I, impulsivity; LTD, long-term difficulties; S, self-consciousness; SLE, stressful life-events; V, vulnerability.
* = p < 0.002.
** = p < 0.001.
*** = p < 0.0001.
[a] Percentage change of 1SD of the diet quality scale associated with 1SD change in the predictor.
[b] Averaged across models in which stress is modeled alongside the four neuroticism traits.
[c] Averaged across models in which neuroticism trait is modeled alongside the two stress indices.
[d] Percentage change in the odds of developing depression/anxiety associated with 1SD change in the predictor.

to −0.08). For self-consciousness, impulsivity and vulnerability, the decrease in diet quality associated with one unit increase was −0.04 (CI = −0.03 to −0.05), −0.05 (CI = −0.03 to −0.06) and −0.05 points (CI = −0.04 to −0.06), respectively. None of the stress-by-neuroticism interactions were associated with diet quality.

3.2. Overall diet quality and depression/anxiety (Path B)

The averaged B-path was not significant (β_{LLDS} = −0.0006, p = 0.6773), nor was the B-path in any individual model. Thus, overall diet quality did not predict the development of depression/anxiety 3.6 years later. Cross-sectionally, the averaged association between diet quality and depression/anxiety was not significant either (β_{LLDS} = −0.0029, p = 0.0175, ST2). However, B-paths were significant in four cross-sectional individual models (SLE-SC, SLE-I, LTD-SC and LTD-I), indicating a 0.3%–0.4% reduction in risk of depression/anxiety with 1SD increase in diet quality. This corresponds to −0.06% (CI = −0.2 to −0.9%) to −0.07% (CI = −0.04 to −0.1%) risk with every unit increase on the diet quality scale (ST2).

3.3. Mediation via overall diet quality

The total effects of stress, neuroticism and stress-by-neuroticism interactions consisted only of direct effects (98.55–100%). No indirect/mediation effects via diet quality were significant, neither averaged nor in individual models (ST1). Cross-sectionally, indirect paths were significant in two models (ST2): 1.1% (CI = 0.59–1.69%) of the total effect of impulsivity was mediated by diet quality. 1SD increase in impulsivity corresponded to 0.02% increase in risk of depression/anxiety via diet quality (versus +1.6% increased risk not via diet quality). For self-consciousness, 0.22% of the total effect (CI = 0.10–0.36%) was mediated by diet quality. 1SD increase in self-consciousness corresponded to 0.01% increase in risk of depression/anxiety via diet quality (versus +4.6% not via diet quality).

3.4. Overall diet quality and covariates

Age, sex, BMI and educational attainment were associated with diet quality (p < 0.0001). Diet quality increased with age by 0.22 points/year, and decreased with BMI by 0.02 points per additional kg/m^2. Being female corresponded to +3.2 diet quality points compared to being male. Educational attainment was associated with higher diet quality (+1.4 points in higher vs. middle and in

middle vs. lower education). No mediation/indirect effects became significant when removing covariates from the model (ST1).

3.5. Sensitivity analyses

Defining follow-up depression/anxiety on a continuous scale, or modeling depression and anxiety separately did not change our findings (data not shown). Furthermore, in men/women, younger/older participants and individuals with depression/anxiety at baseline, indirect effects and B-paths remained non-significant (ST3). However, subgroup analyses did reveal between-group differences in the A-paths, especially between males and females. Poor diet quality was more strongly associated with impulsivity, stressful life-events and long-term difficulties in males, and with vulnerability, anger-hostility and self-consciousness in females (ST3).

4. Discussion

In a large population-based sample, we investigated whether overall diet quality mediated the effects of well-established risk factors for the development of depression and anxiety. While baseline stress exposure, neuroticism and their interaction predicted later depression/anxiety, these effects were not mediated by overall diet quality. Stress and neuroticism were associated with overall diet quality at baseline, although effects were small. Baseline diet quality, in turn, did not predict depression/anxiety at follow-up.

In smaller samples, two prior studies assessed the mediating role of diet quality in the development of depression. In Swedish workers, the absence of workplace social support (=stressor) was associated with depressive symptoms four years later. In line with our findings, overall diet quality at intermediate time points did not mediate this relationship [24]. In the United States National Health and Nutrition Examination Survey (NHANES) data, the association between shift work (=stressor) and depressive symptoms was partially mediated by the Dietary Inflammatory Index score (which correlates negatively with overall diet quality score) [25]. The latter study was cross-sectional, and the proportion of effect mediated by diet was not reported. The effects of shift work may differ from those of stressful life-events or long-term difficulties. Possibly, associations between shift work, diet quality and depression/anxiety are attributable to altered circadian rhythms more so than to stress.

Our findings urge critical appraisal of the recently published dietary recommendations for the prevention of depression, commending a diet rich in fruit, vegetables and wholegrain products, among others [26]. We find no evidence that diet quality influences depression risk in the general population. Our findings suggest that protective effects of whole-of-diet interventions on the development of depression/anxiety, as reported in approximately half of the available clinical trials [3], are unlikely caused by nutritional intake. Neither in the full sample, nor in only those with pre-existing depression/anxiety, did overall diet quality predict poor mental health outcomes. Beneficial effects achieved in trials might be attributable to, for instance, participants' sense of self-efficacy or therapeutic context. Small-study effects and publication might also play a role.

Our relatively long follow-up interval (3.6 years), especially compared to most clinical trials, might have contributed the absence of mediation effects. Effects of diet quality may be shorter-lived. Our cross-sectional findings, however, provide little support for this hypothesis. Small proportions of only two associations were mediated by diet quality, i.e. 0.2% and 1.1% of the associations between self-consciousness and impulsivity, respectively, and depression/anxiety. Note that the order of events cannot be established: negative effects of depression/anxiety on dietary choices likely contribute to the observed mediation as well [27]. Thus, although the possibility of diet quality predicting depression/anxiety within a shorter timeframe cannot be excluded, our largely negative cross-sectional findings suggest that it is unlikely.

Our A-path findings are also of interest. Our findings support associations between neuroticism traits and diet quality, and between stress exposure and diet quality, but their strength falls short of those previously reported. In our study, a one-point difference in diet quality (scale 0–48) required a twenty-point difference in impulsivity (scale 8–40) or past-year exposure to eleven additional stressful life-events. Results of some prior (smaller) studies might have been inflated due to sample selection (e.g. college students). Age-dependent associations between neuroticism and diet could in the future offer potential for lifestyle interventions targeting specific groups. Regarding path A_3, experimental studies had suggested that high-neurotic individuals may be more prone to unhealthy food choices when faced with stress compared to low-neurotic and non-stressed individuals [9]. Here, we find no evidence for stress-by-neuroticism interaction effects on diet quality in real-life circumstances, confirming null findings of a prior study of socio-economic deprivation [28].

Our study is optimally suited to investigate effects of diet quality in the general population. Energy and macronutrient intake within Lifelines closely matched those in a second (independent) Dutch sample [29], and our diet quality indicator showed the expected associations with age, sex and educational attainment. In the absence of effects in the general population, we explored (post-hoc) whether diet quality might predict depression/anxiety in affected individuals only. This was not the case. Since lifestyle interventions are often considered a viable treatment option for those with less severe symptoms, we additionally investigated subtler changes using number of depression/anxiety symptoms rather than a binary outcome. Again, outcomes remained unchanged. Our observational findings do not preclude that dietary interventions reduce depression/anxiety, but they do make it less plausible that such beneficial effects, if any, are related to dietary intake.

An important limitation of the current study lies in the fact that stress exposure/neuroticism and diet quality were measured simultaneously, i.e. at baseline. Our results thus support associations between stress/neuroticism and diet quality, but the direction of effect cannot be deducted. Personality traits are substantially driven by genetic factors, suggesting a likely effect of neuroticism on diet rather than the other way around. However, animal research has suggested that nutrition can also shape personality [30]. In addition, if baseline stress/neuroticism affected diet quality during the follow-up period, (unmeasured) diet quality between baseline and follow-up might still be a mediator. By contrast, the more controversial B-path of the hypothesized pathway to developing mental health problems, running from overall diet quality to depression and anxiety, was modeled based on repeated measurements and allows prospective interpretation.

Summarizing, overall diet quality does not mediate pathways from stress exposure and neuroticism to depression/anxiety 3.6 years later. Both stress and neuroticism were associated with diet quality, but diet quality in turn did not predict the development of depression/anxiety. Associations between real-life stress/neuroticism and diet quality are weak, especially compared to effects previously reported in experimental studies. Our findings suggest that dietary changes are unlikely to, in the long-term, prevent the

onset or recurrence of depression/anxiety in the general population.

Credit author statement

LJSS: conceptualization, formal analysis, writing – original draft, writing – review and editing, visualization; HL: conceptualization, supervision, writing – review and editing; PCV: data curation; LL: writing – review and editing; LGK: writing – review and editing; AAV: funding acquisition, writing – review and editing; JH: conceptualization, supervision, writing – review and editing; CAH: conceptualization, supervision, writing – review and editing.

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Conflict of interest

H Larsson has served as a speaker for Evolan Pharma and Shire and has received research grants from Shire; all outside the submitted work. All other authors certify that they have no affiliations with or involvement in any organization or entity with any financial or non-financial interest in the subject matter or materials discussed in this manuscript.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.clnu.2020.06.016.

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